

Electroencephalogram Recordings and Artifacts

The good, the bad, and the ugly (and what to do about them)

Visually evaluating EEG signals for their quality is a skill that takes time and experience to develop, and practice to hone. To that end, this document has been collated to provide visual reference to what a good quality EEG signal looks like, and what commonly observed artifacts/issues also look like.

As a broad note, these artifacts/issues each have varied priorities in terms of how fast a response/fix is required and/or when they should be fixed. So, the visual material has been indexed into three separate sections:

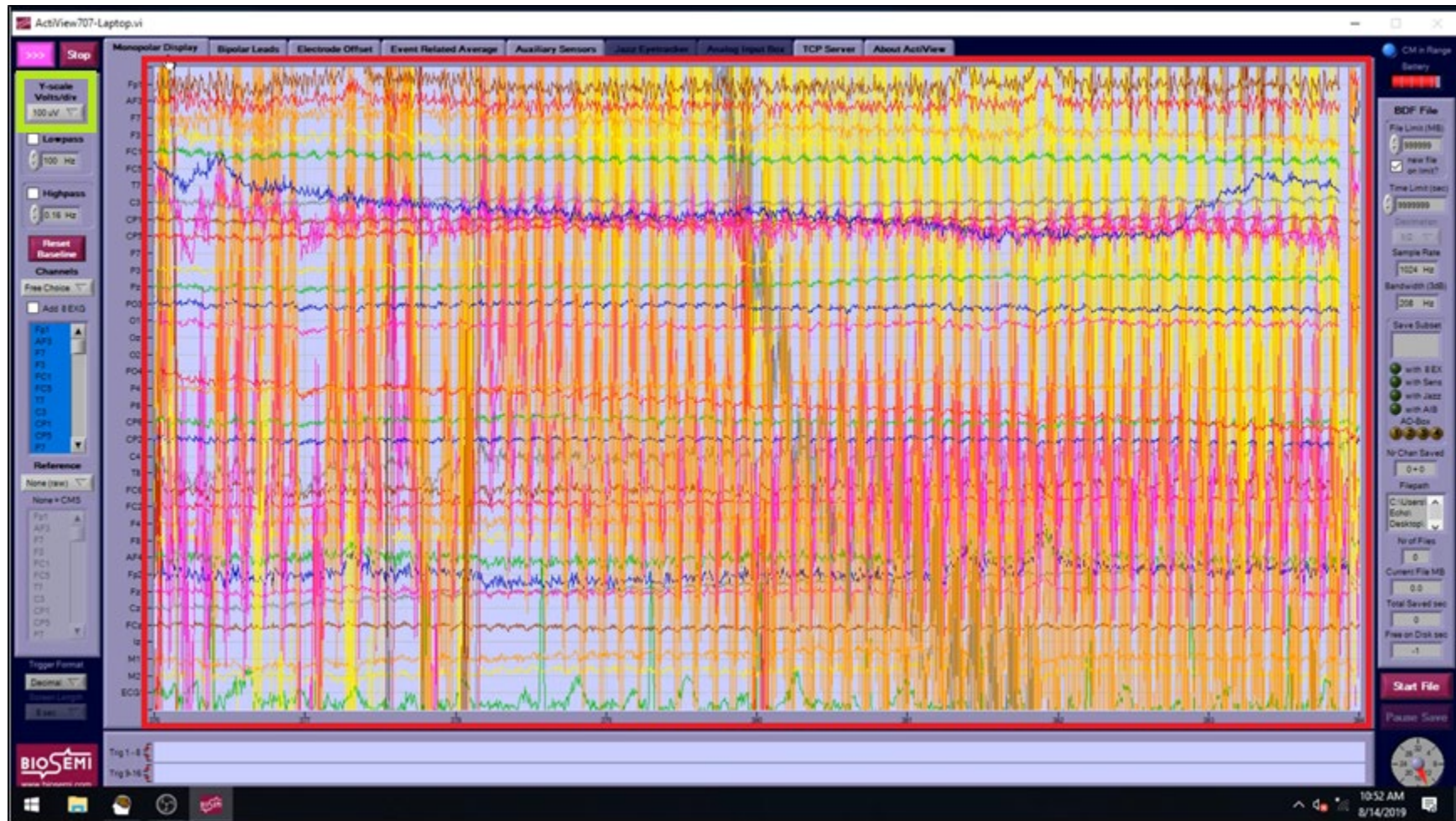
1. The Good: an example of a clean recording that you want to be as close as possible to.
2. The Bad: issues and artifacts that you want to correct immediately
 - a. These should be corrected prior to starting a recording if possible, or as soon as they are noticed/possible.
 - b. Be mindful that sometimes:
 - i. You may need to correct issues/artifacts inside certain time windows so as to not disturb the rest of the recording
 - ii. You may not be able to directly fix the issue (e.g. broken wires/electrodes) and can continue with the immediate recording, but need to have it fixed before the next recording.
3. The Ugly: issues and artifacts that make the recording ugly, and may or may not be problematic.
 - a. Correcting these often depends on how frequently, and when in the recording they occur.

Following the photo/screenshot of each of the artifacts/issues some advice or suggestions on how to fix/counteract them is provided.

As a final note, each artifact has been marked in its picture through the use of a red box.

The Bad – Things to correct as soon as possible

Miscellaneous or Hard to Identify Noise



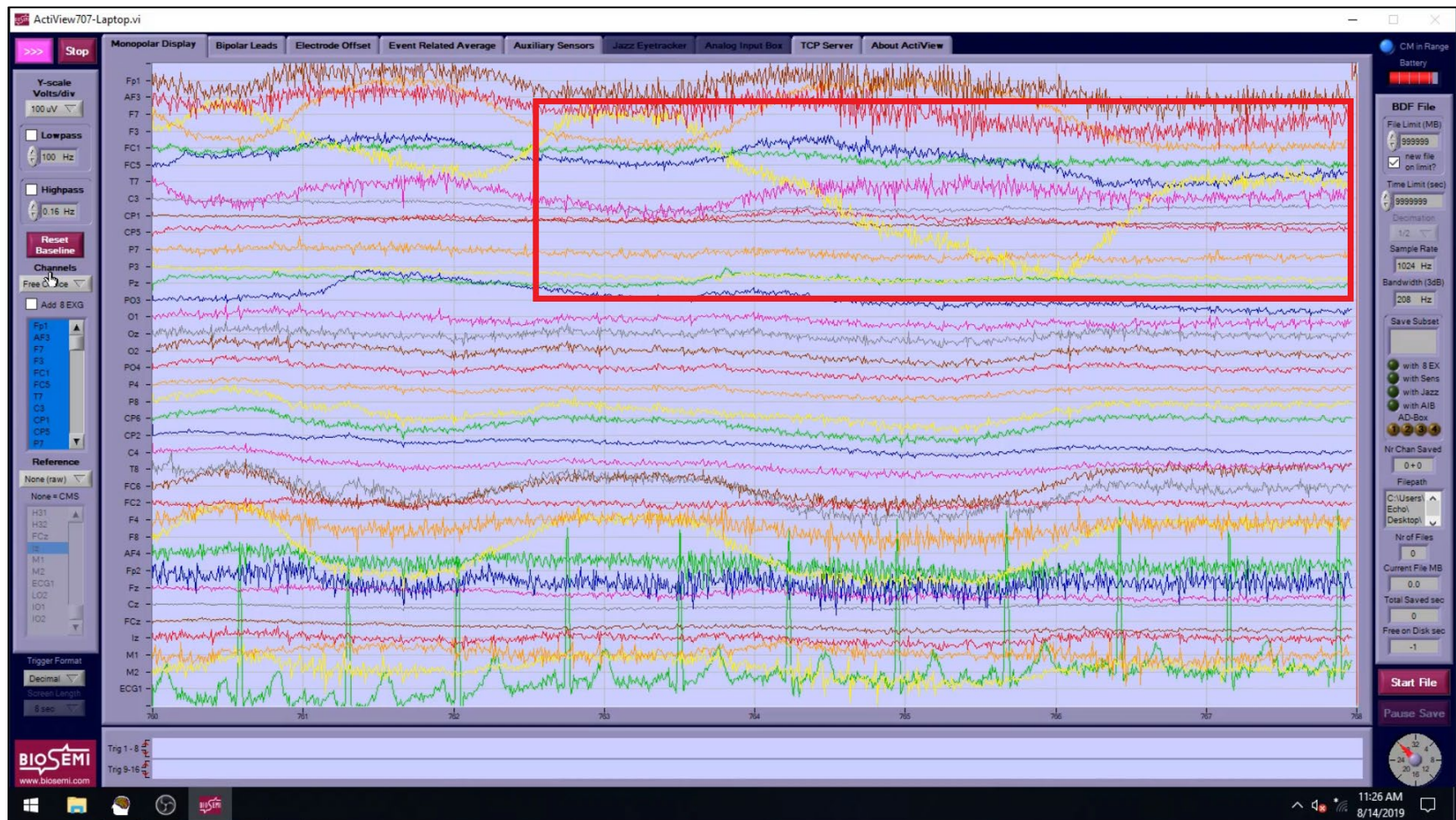
- The easiest place to start is to check and ensure that the CMS/DRL electrodes are correctly gelled and making good contact.
- To help view bad channels and/or artifacts/issues you can also adjust the voltage scale (top left, outlined in light green) to something larger than the default of 100 μ V (say 100 mV) as this can help to spacing each channel out and make them easier to visualise.

Poor DC Offsets



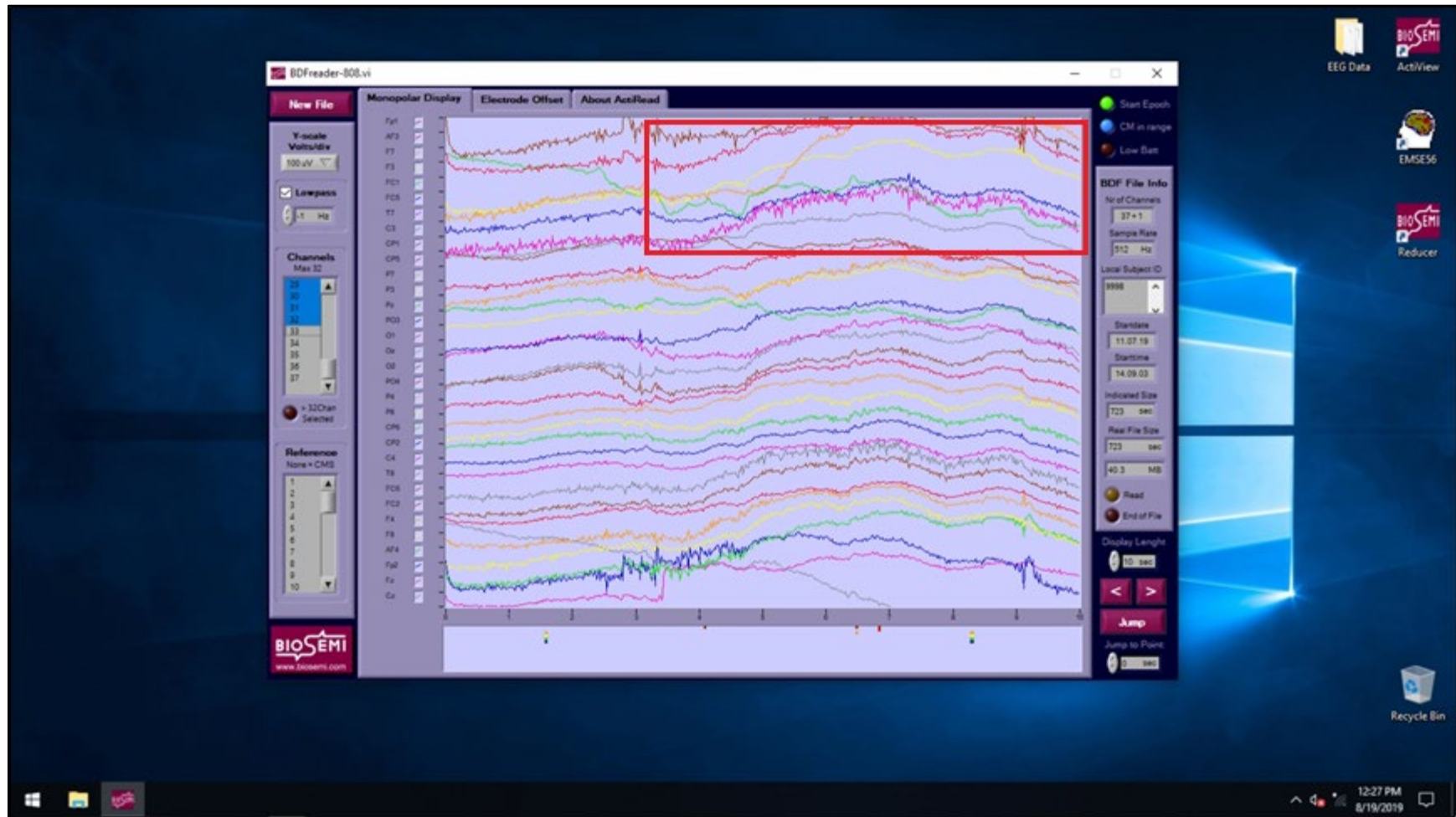
- Most of the time, high values can be corrected by ensuring that the electrode in question and the CMS/DRL electrodes all have adequate gel, and are correctly inserted into the electrode holder in the cap.
 - o If this does not correct the DC offsets, they may need to be repaired and you should conduct the salt test to check.

Wandering/Drifting Baseline/s



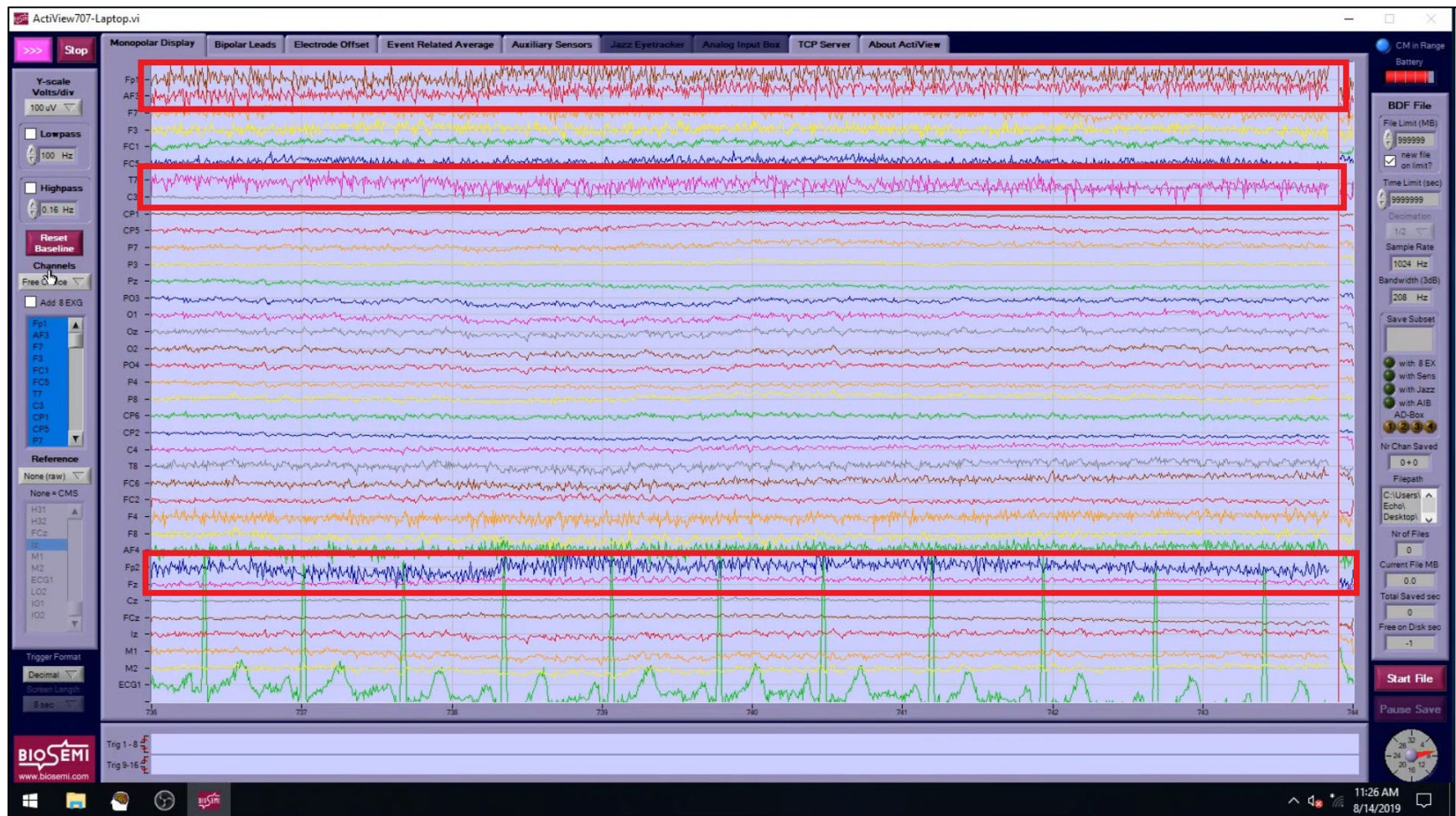
- Easiest steps are to ask the participant to minimise any movements, and to be mindful of how deeply they are breathing.
- You may also want to check and ensure that the electrode leads are not caught on anything, and are not being pulled in any way that would move the electrode (this can be preempted during set-up by making sure the leads have some slack)
 - o If leads were being pulled make sure to check the position and contact of the affected electrode.

Skin Potentials



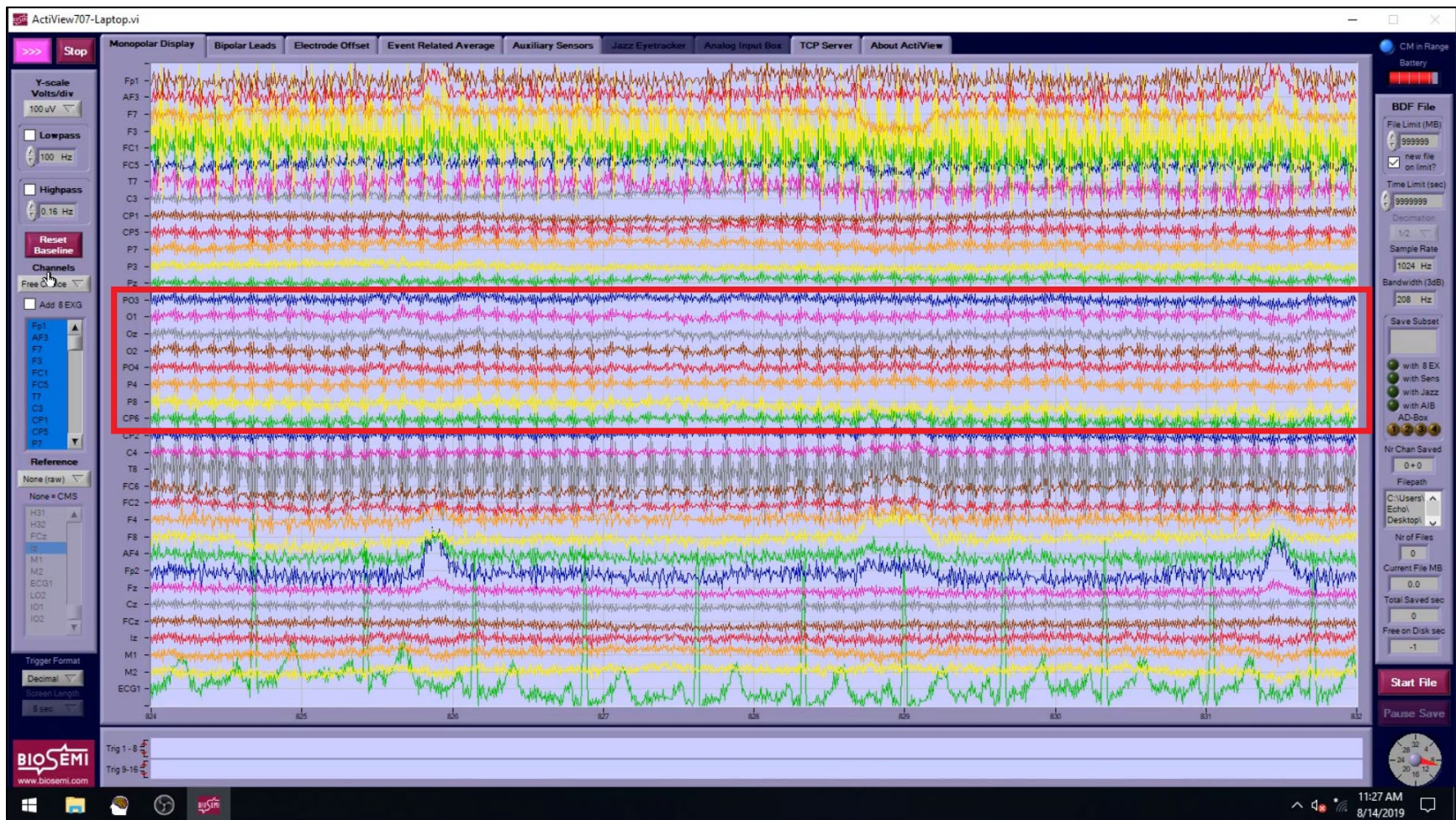
- It is most easily fixed by ensuring that the data collect room temperature is in a comfortable range (70-75°F; 21-24°C)
- You can also advise participants to layer buttoned/zippered clothing, so it can be removed easily without disturbing electrodes.
- Lastly, they often settle over time so do not be afraid to give them time, and pause recordings if needed/possible if they are very prominent.

Noisy electrode/s (without a poor DC offset)



- Firstly, check that the electrode is correctly inserted into the electrode holder. If not, it should be reseated. If this doesn't improve the noise, you may want to add some more gel and see if that improves the contact.
- If the signal does not improve, be mindful that sometimes an electrode may just be noisier for that participant. If you think the electrode may need to be repaired, you should conduct the salt test (after finishing with your participant/the next day) to check.

Electrical Interference



- It can often be corrected by ensuring the participant is not contacting any conductive surfaces and/or power cables, and reducing the number of powered devices (particularly non-grounded) in your data collection space.
- In more complex situations you may need to consider the lighting of the room (turning it off, or changing it) you are working in.

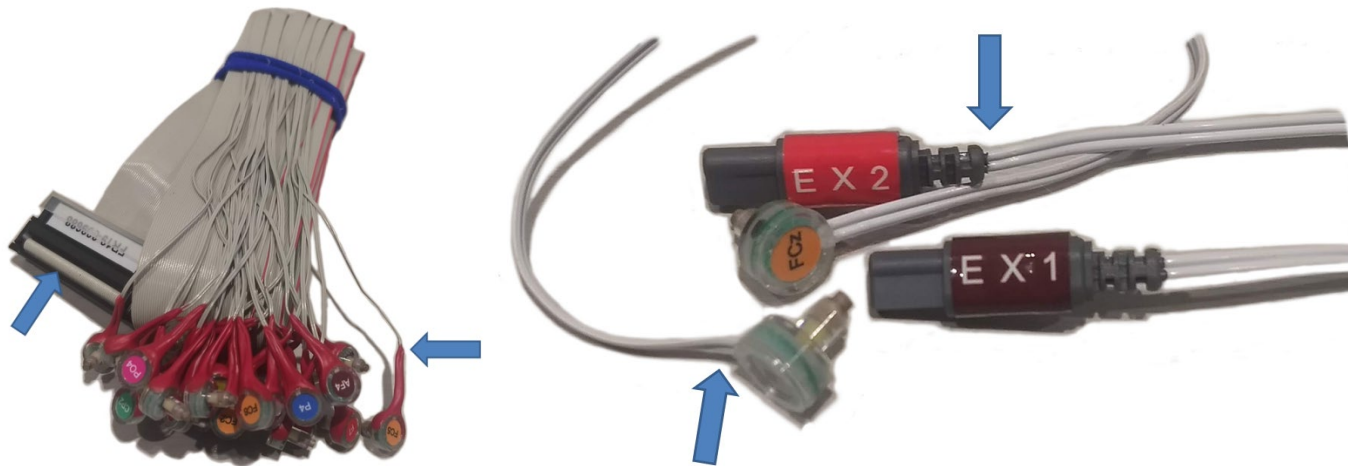
Broken/Damaged Electrodes, Leads and/or Wires

Broken and/or damaged electrodes can sometimes be difficult to diagnose, and typically require repair and/or replacement.

In the below images, the blue arrows indicate structural weak points of the electrodes which are most likely to see damage and break.

If you suspect a broken electrode it is worth checking the cables (and these points) for:

- Damage to the plastic insulation; kinked cables, damage to the connectors, and exposed wires.



At a later point in time, if you suspect that an electrode is damaged and/or broken you should complete the bucket test (see SOP for details; or https://www.biosemi.com/faq/check_electrodes.htm and <https://www.youtube.com/watch?v=PvK7D0gt8XM>).

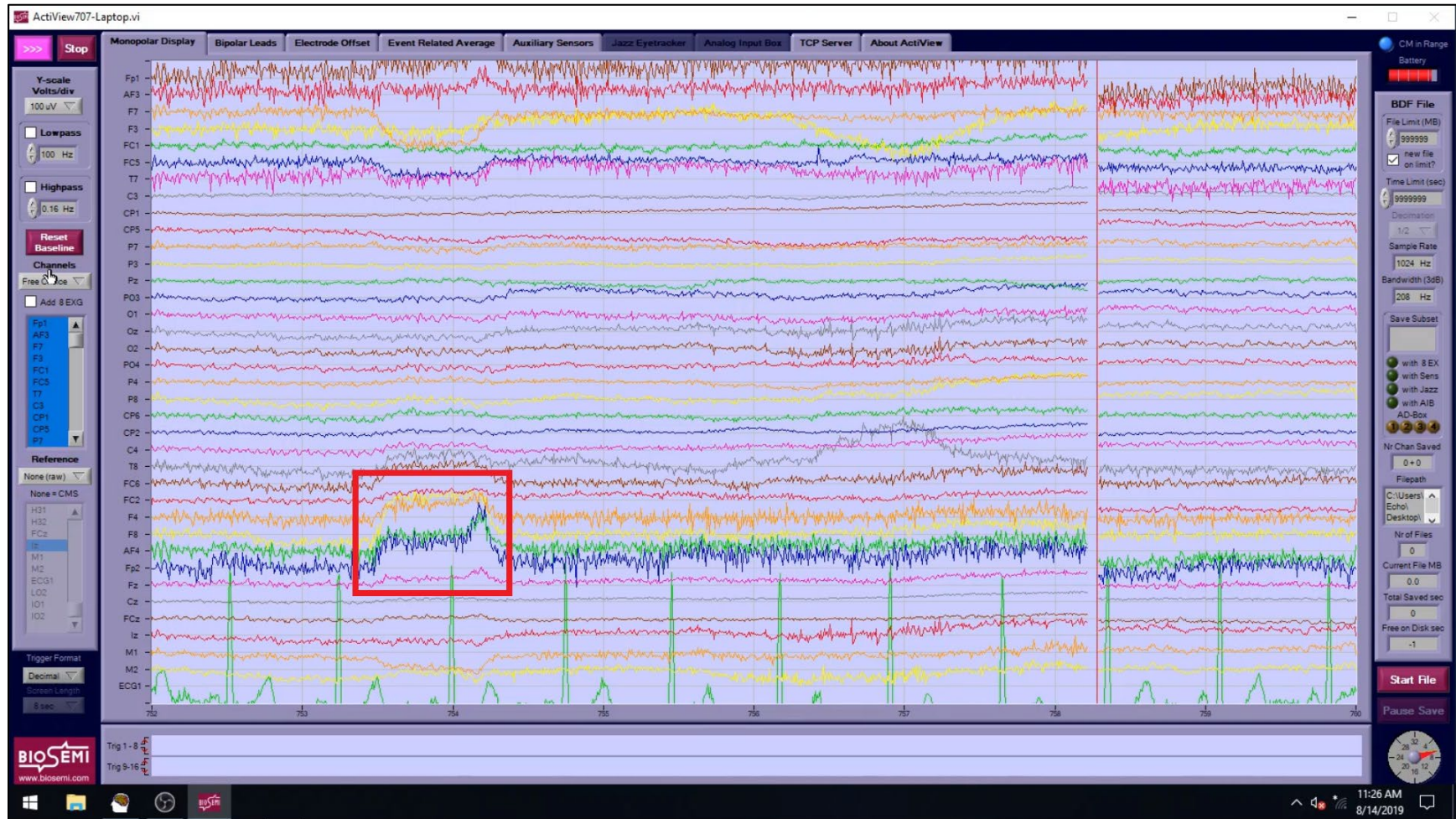
- If the electrode fails this test it will need to be sent for repair; if it passes the test, monitor the electrode/s ongoing performance.

In the instance of a repair being necessary you should initially notify your Project managers and the rest of your RA team, and make sure to switch to the spare electrodes.

Repairs are facilitated by Cortech Solutions, you can reach them via (910) 362-1143 or support@cortechsolutions.com

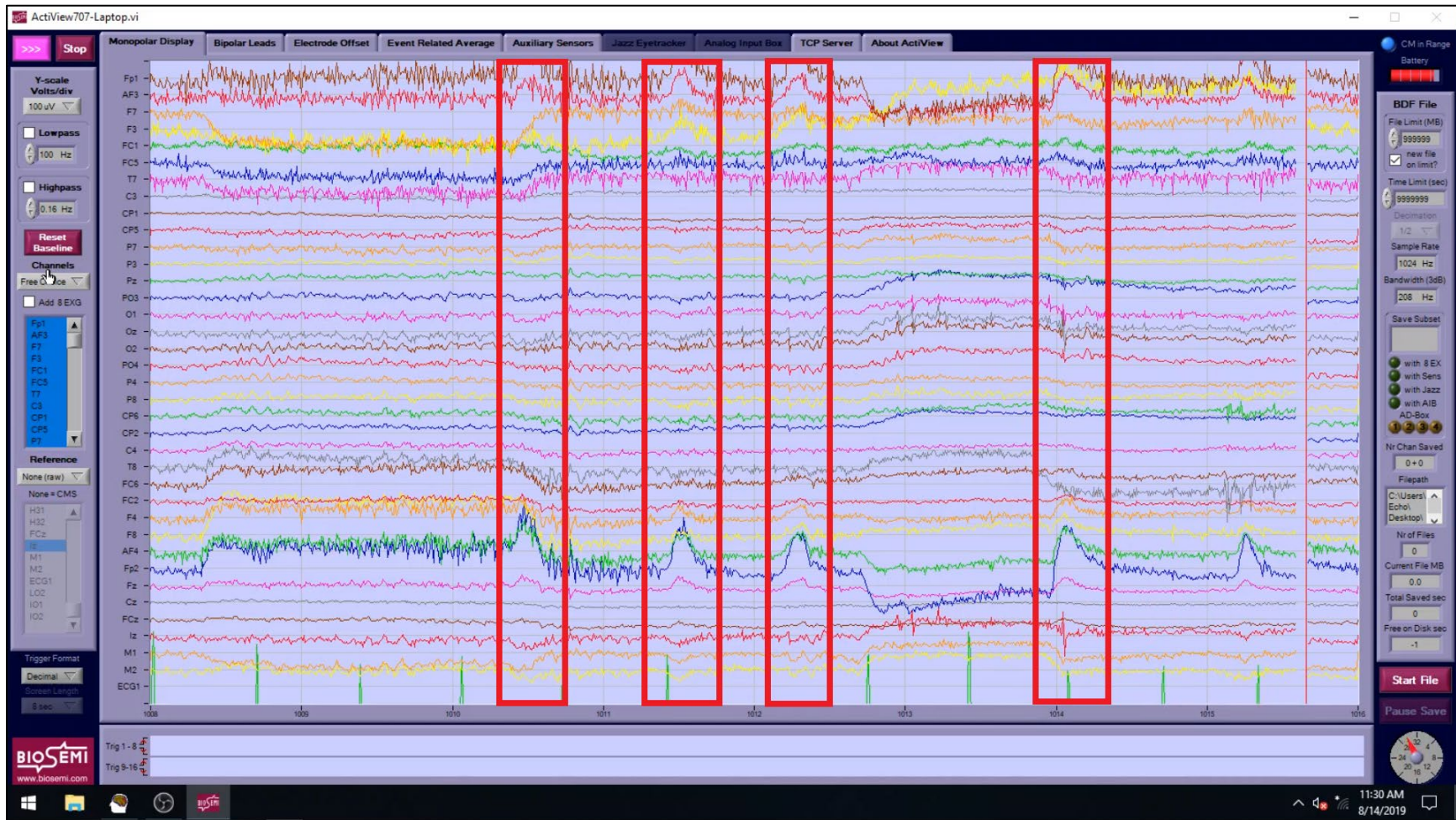
The Ugly – Everything else...

Lateral Eye Movements



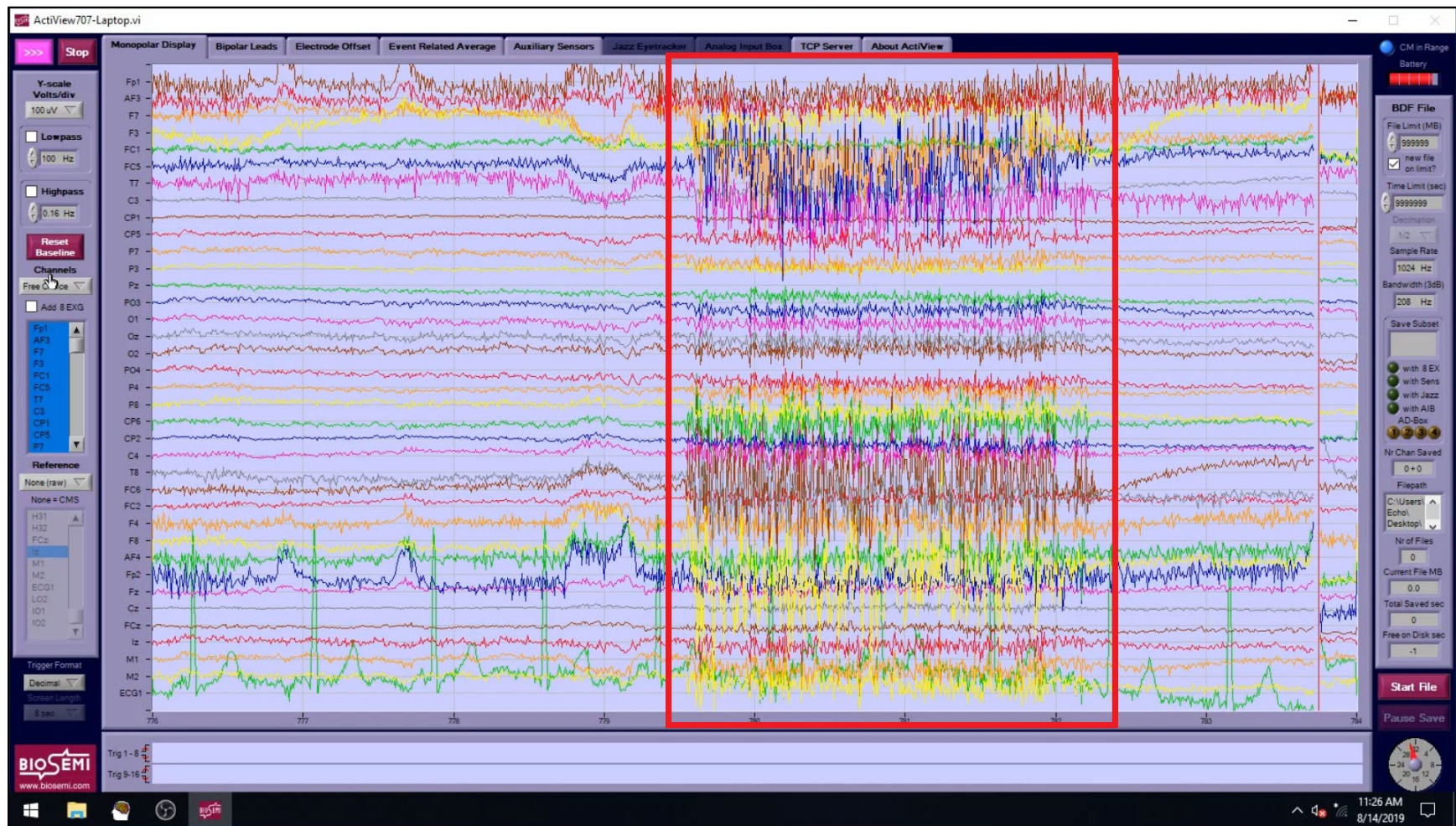
- Not typically a problem that you need to correct unless they are occurring frequently.
- If they are frequent, direct the participant to refocus on the screen and avoid side to side eye movements/looking around.

Eye blinks



- They may or may not be problematic depending upon your exact experiment. Often their timing is the most problematic component, and in some instances, you may want to advise the participant to try to blink less, or at certain times.
- If they are occurring frequently, it is worth asking if anything is wrong with the participants eyes.
- Can also be exacerbated by excessively cold air, fatigue, tired eyes, contact lenses, or not wearing corrective lenses if they are required.

Muscle Activity/Interference



- Not typically a problem that you need to correct unless they are occurring frequently.
- If they are frequent, you should remind the participant to minimise any movement particularly of the head, neck and shoulders. You can also alert participant to the fact they could be tensing (particularly if they need to concentrate on a task), and that they should try their best to relax.